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ABSTRACT

The factor structure of the Wechsler Intelligence Scale for Children (Revised) (WISC-R) for both regular and special education populations has been well documented. Published data have also indicated that the factor structure of the WISC-R is similar across ethnic groups. With the development of the new WISC-III, comparable information is not yet well established. In particular, the addition of a new subtest and a new hypothesized fourth factor require additional data about the psychometric properties of the WISC-III. This study examines the factor structure of the WISC-III in a population of 121 Mexican American learning disabled elementary school students. Factorial similarities and differences with the WISC-III normative sample and with the WISC-R are provided. Implications for school psychologists are discussed as are suggestions for future research. Results indicate that the WISC-III Full Scale, Verbal, and Performance intelligence quotients can be thought of as relatively independent indices of intelligence in diverse populations. Two tables present study findings. (Contains 9 references.) (Author/SLD)

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Factor Structure of the WISC-III for Mexican-American, Learning Disabled Students.

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Abstract

The factor structure of the WISC-R for both regular and special education populations has been well documented. Published data have also indicated that the factor structure of the WISC-R is similar across ethnic groups. With the development of the new WISC-III, comparable information is not yet well established. Particularly with the addition of a new subtest, and a hypothesized new fourth factor, additional data regarding the psychometric properties of the WISC-III are required. This study examines the factor structure of the WISC-III in a population of Mexican-American, learning disabled students. Factorial similarities and differences with the WISC-III normative sample and with the WISC-R are provided. Implications for school psychologists are discussed as are suggestions for future research.

Factor Structure of the WISC-III for Mexican-American, Learning Disabled Students.

The Wechsler Intelligence Scale for Children-Revised (WISC-R) has been the most commonly used instrument to measure the intellectual functioning of children referred for psychological evaluations in public school settings. Particularly with the IDEA mandate that children who are referred for psychological evaluation be assessed in their native language, the psychometric properties of the WISC-R with minority students have been under close scrutiny.

Although minority children have often been shown to score lower than majority children by an average of one standard deviation (15 points) on the WISC-R, the psychometric properties of the WISC-R do not appear to be biased across ethnic groups. Particularly with regards to the factorial validity of the WISC-R, research exists which demonstrates similar factor structure for children from different ethnic groups including Black, Mexican-American and Anglo (Geary & Whitworth, 1988; Kaufman, 1975; Sandoval, 1982; Taylor & Ziegler, 1987).

With the development of the third edition of the Wechsler Intelligence Test for Children (Wechsler, 1991), similar conclusions have yet to be supported in the research literature. Obvious changes between the WISC-R and the WISC-III which may impact the performance of minority children include updated questions, improved artwork and the addition of the new Symbol Search

subtest. Less obvious changes include the fact that the WISC-III standardization sample was stratified on the ethnicity variable differently than was the WISC-R. While the WISC-R merely used a white/nonwhite classification, the WISC-III is more specific, defining ethnicity as white, black, Hispanic and other. Equally important is the fact that the SES stratification variable of parent occupation was replaced by parental level of occupation on the WISC-III.

Previous WISC-R research concerning the factor structure for both regular and special education populations has been well documented (Reynolds & Kaufman, 1990). While a single g factor has consistently been shown to underlie the first principal factor, psychometricians are in some disagreement as to whether a two factor (verbal/performance) or three factor (freedom from distractibility) solution is most appropriate in describing WISC-R performance. With the creation of WISC-III a fourth factor has emerged, Processing Speed, although research has yet to be produced to describe its psychometric properties.

Regardless of the number of factors which Wechsler IQ tests have identified, most research has demonstrated factorial similarity across ethnic groups. The primary objective of this study was to examine the factor structure of the WISC-III in a population of Mexican-American, learning disabled students.

Method

Subjects

A total of 121 Mexican-American students who received comprehensive psychological evaluations during a two year period served as subjects. The sample included 84 males and 37 females in grades one through eight. Students were selected from 4 school districts in urban and suburban Phoenix, Arizona. Children came from both English and Spanish speaking, low-middle- and middle-class socioeconomic backgrounds. School records indicated that the primary language of all students was English.

Procedure

The WISC-III was administered by state certified school psychologists as part of the psychoeducational evaluation process to determine eligibility for special education services. Additional achievement batteries, rating scales, and measures of social emotional functioning were also included as part of the assessment process. Students were subsequently selected from special education records based upon two criteria: (1) cognitive assessment included the WISC-III; and (2) diagnosis of learning disability (LD). Arizona special education rules and regulations which governed diagnostic decisions, which are similar to IDEA rules, defined learning disability as a significant ability-achievement discrepancy.

Scaled scores from the 12 WISC-III subtests (Mazes was excluded from all analyses) combined to form a 12 x 12 correlation

matrix, which was initially subjected to a principal component analysis (with squared multiple correlations in the diagonals). This analysis was followed by a varimax rotation of all factors exceeding the Kaiser-Guttman criteria of eigenvalues of 1.0 or greater.

Results

Descriptive statistics for Verbal, Performance, and Full Scale IQ scores of the WISC-III, as well as the four factor scores are presented in Table 1 along with reading, math, and written expression achievement scores. Consistent with results from the WISC-R, the Full Scale IQ is approximately one standard deviation below the nationally standardized mean. Similarly, as has been found for other Mexican-American samples, the average Performance IQ from the current sample is higher than the Verbal IQ. Academic achievement is discrepant from intellectual ability across all academic areas.

Insert Table 1 about here

Results of the principal component and factor analyses are presented in Table 2. An examination of the first unrotated factor of the principal component analysis indicates that a substantial percentage of total WISC-III variance (33%) is accounted for by a large underlying g or general component. Results of the varimax-rotated factor analysis confirm two major factors and two smaller, somewhat less interpretable factors.

Insert Table 2 about here

The first two factors appear to reflect the expected Verbal Comprehension and Perceptual Organization dimensions. Taken together these two factors comprise 44% of the total test variance which is very similar to the standardization sample in which they accounted for 45% of WISC-III variance. Interpretation of the third factor is also relatively straightforward with the loadings of Coding and Symbol Search being reflective of the Processing Speed factor. Loadings on the fourth factor are somewhat less clear however. Digit Span clearly loads with additional, but less striking, loading coming from the Picture Arrangement and Arithmetic subtests. While this might be labeled the Freedom from Distractibility factor, it is important to note that Arithmetic yields a higher loading on the first factor (Verbal Comprehension) and Picture Arrangement also loads significantly on the Perceptual Organization factor. With these two subtests each loading simultaneously on two factors the appropriateness of recognizing Freedom from Distractibility as an independent fourth factor is called into question, unless one is willing to define this factor as consisting of the single subtest Digit Span. It appears that the creation of a fourth factor actually serves to call into question the meaning of the third factor.

Discussion

Our results provide preliminary support for the construct validity of the WISC-III in a population of Mexican-American, learning disabled students. As expected, results of the present study indicate that the WISC-III continues to yield a substantial g loading for Mexican-American, learning disabled students. This loading is very similar to findings derived from the standardization sample. Overall, the WISC-III continues to be a solid measure of general intellectual functioning, even in the present culturally diverse, special education population.

As expected, the verbal and performance scales remain intact and also appear to offer much diagnostic interpretability. The verbal factor remains straightforward with four strong subtest loadings as does the perceptual organization factor although it is defined by only three strong loadings - Picture Completion, Block Design and Object Assembly. Student PIQ'S were greater than VIQ's as would be expected in a learning-disabled population (Sattler, 1988) particularly when they were derived from a Mexican-American population.

The interpretation of the third and fourth factor is somewhat less clear. While Processing Speed did emerge similar to the standardization sample, the Freedom from Distractibility factor is less obvious. Picture Arrangement is difficult to interpret because it loads on several factors and similar to standardization analyses, the addition of the symbol search subtest failed to strengthen the

freedom from distractibility factor. While Digit Span clearly does not load on the first three factors it remains unclear exactly what this subtest is measuring. As Kamphaus (1993) points out, it is ironic that the newly created fourth factor may turn out to be more interpretable than the third factor. While the processing speed factor does appear to demonstrate adequate factorial validity, it's predictive validity had yet to be adequately demonstrated. Neither type of validity is yet adequate for the freedom from distractibility factor.

Results of this study indicate that school psychologists can reasonably conclude that like the WISC-R, the WISC-III Full Scale, Verbal and Performance IQ's can each be thought of as relatively independent indices of intelligence in populations as diverse as learning-disabled, Mexican-American students. Empirical support is less evident for the use of other factor scores, freedom from distractibility and processing speed. When school psychologists choose to interpret these last two factors it must be done with great caution. It should continue to be a best practice to use these factors scores only as descriptors of student strengths or weaknesses and never as a diagnostic indicator.

Several limitations of this research should be considered when examining these results and conclusions. While the purpose of this study was exploratory, the characteristics of the population of students in the present study may not extend to other learning disabled populations or ethnic groups. No attempt was made to

control for variables such as language proficiency, SES, parental education or migration, and consequently, generalization of these findings to learning-disabled, Mexican-American populations outside of the Southwest must be empirically tested. In addition, the number of cases submitted to factor analysis in the current study was not sufficient for stable conclusions (Comrey, 1978) so these results should be accepted as tentative until confirmed by larger, more diverse samples. Future research should examine the possible differential factor structure of the WISC-III across ethnic groups and special education classifications. Similarly, once factorial similarity is established, the predictive validity of the WISC-III IQ and Factor Scores for these groups should be examined as well.

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Table 1

Standard Score Means, Standard Deviations, and Ranges for WISC-III VIQ, PIQ, FSIQ, VC, PO, FD and PS for Mexican-American, Learning Disabled Students

Variable	Mean	SD	Minimum	Maximum
Verbal IQ	83.01	12.01	52	112
Performance IQ	91.24	11.86	68	129
Full Scale IQ	85.60	10.97	61	122
VC Factor	84.62	12.67	52	117
PO Factor	92.05	13.15	62	126
FD Factor	81.93	9.56	55	104
PS Factor	96.11	13.73	64	140
Reading	76.93	14.29	31	106
Math	78.48	14.74	42	112
Written Language	71.98	16.22	30	102

Table 2

Principal Component and Varimax Factor Loadings of the WISC-III for Mexican-American, Learning Disabled Students

Subtest	g Loading	Rotated Factors: Factor 1	Factor 2	Factor 3	Factor 4
Picture Completion	.60	.27	.71*	.10	-.03
Information	.74	.78*	.22	.03	.00
Coding	.18	.08	-.14	.86*	.06
Similarities	.81	.82*	.27	.10	-.03
Picture Arrangement	.50	.27	.37*	-.10	.52*
Arithmetic	.55	.55*	.00	.03	.47*
Block Design	.53	.13	.76*	-.06	.18
Vocabulary	.74	.84*	.16	-.03	-.02
Object Assembly	.54	.07	.81*	.10	.16
Comprehension	.70	.77*	.03	.23	.10
Symbol Search	.43	.13	.30	.80*	.02
Digit Span	.15	-.16	.12	.14	.85*
Percent of Variance Accounted For	33	26	18	13	11

* Significant Factor Loading